Fire Island National Seashore

EXPERIENCE YOUR AMERICA

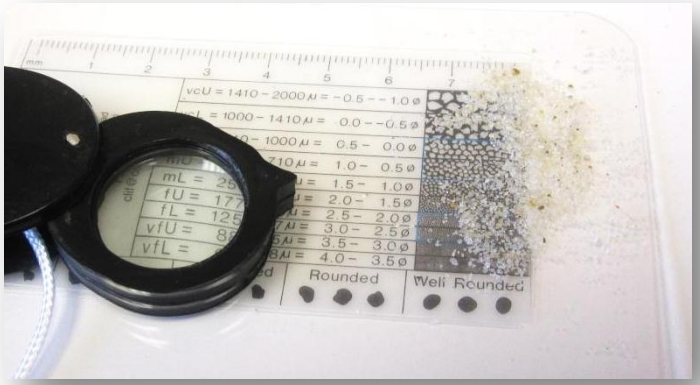
FIELD GUIDE

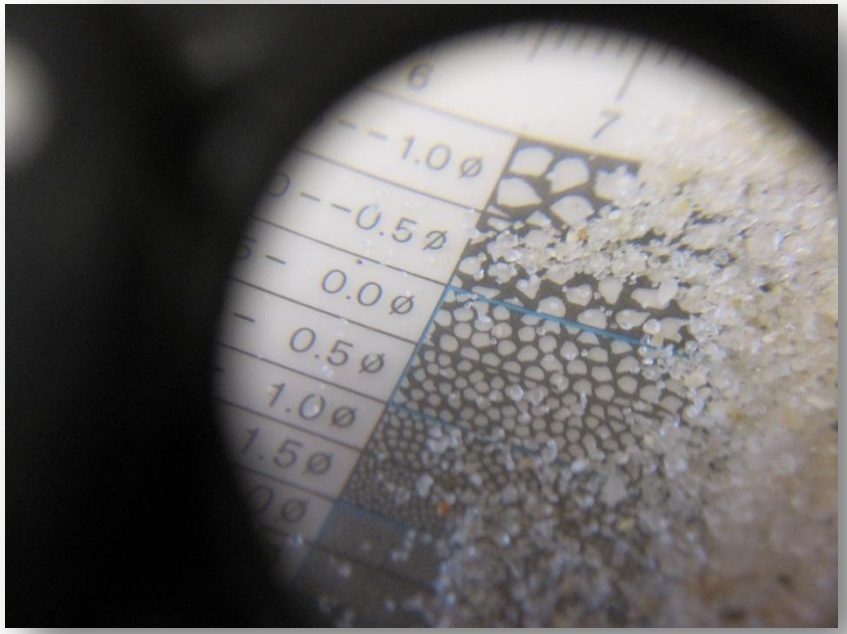
A Companion to the Beach Dynamics Activity Series

All About Sand

- Using the Hand Lens
- Understanding the Grain Size Card
- Mineral Identification
- Magnetic Minerals

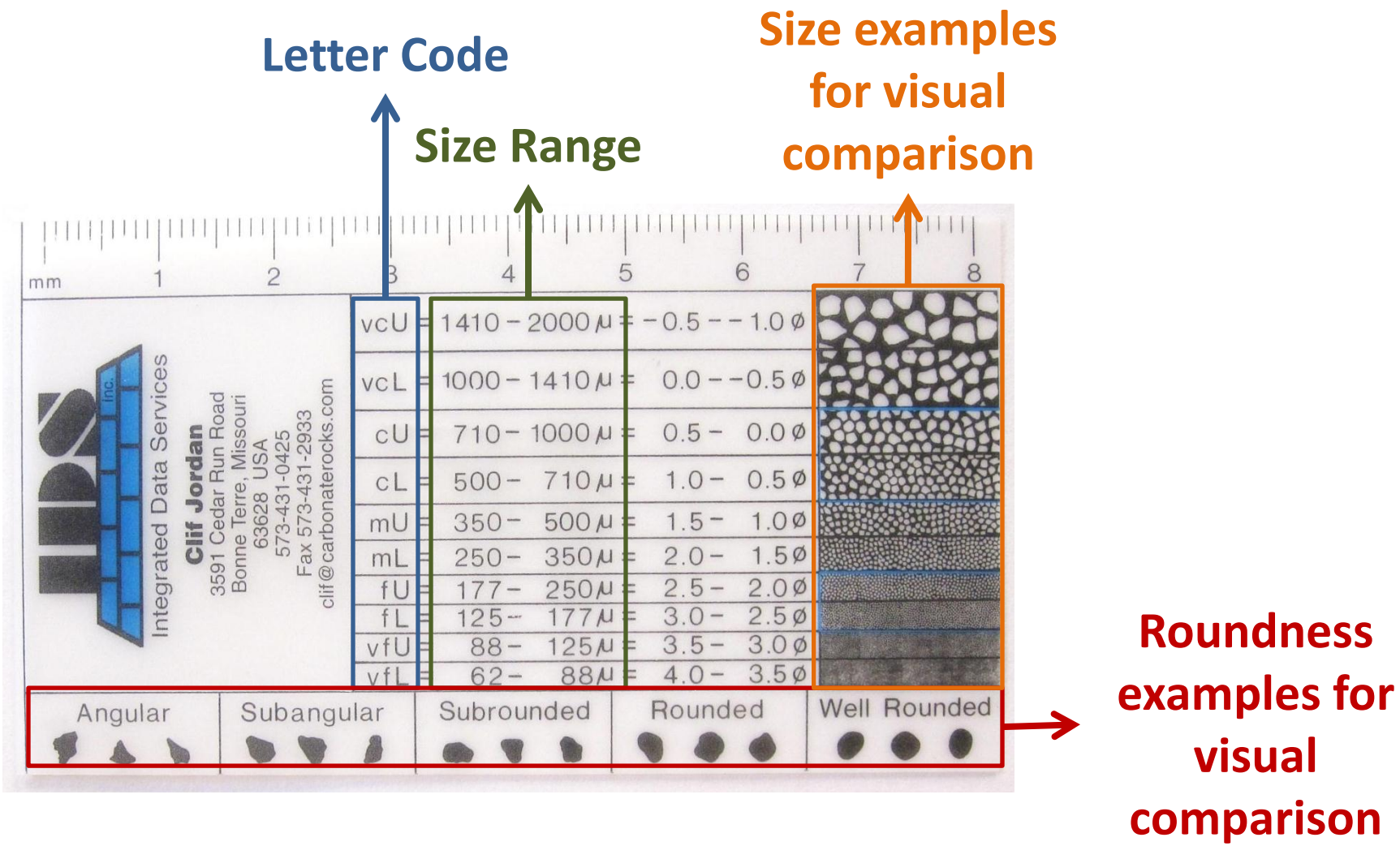
Using the Hand Lens



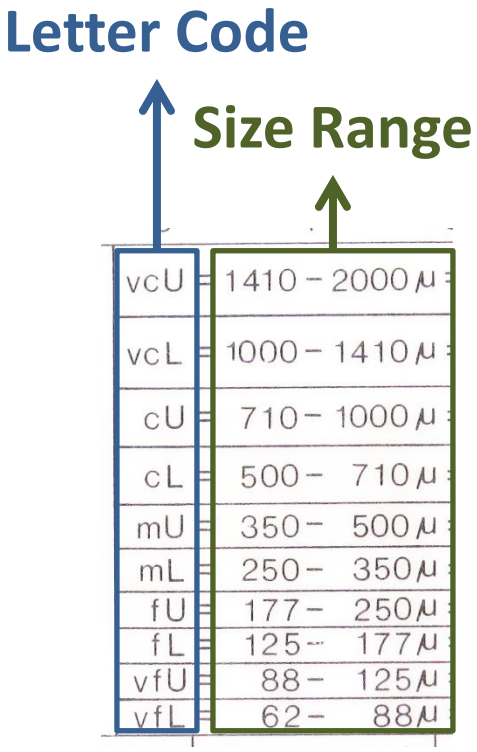


- Sprinkle a small amount of sand on the grain size card near the size examples.
- Hold the hand lens up to your eye and slowly move the grain size card and sample up towards your eye until it comes into focus.
- Compare the sizes and determine which is the closest to your sand sample.

The Grain Size Card



Grain Sizes Explained



- Units are in micrometers (µm or µ)
- Classes of grain size explained:
  - vc = Very Coarse
  - c = Coarse
  - m = Medium
  - f = Fine
  - vf = Very Fine
- The letters U and L identify upper and lower ranges of the class

Example: grains that are vcL are in the lower (L) range of the very coarse (vc) class that has sizes between 1000 – 1410 µm (or 0.1 – 0.141 cm).

Sand Mineral Identification

- **Light Color / Low Density Minerals**
  - *Quartz*: clear to tan, translucent (most common)
  - *Feldspar*: white to tan, milky to opaque (not as common as Quartz)
  - *Shell*: can be any color found in shells, may retain some characteristics of the shell (ridges, thinness, color on one side)

Quartz

Feldspar

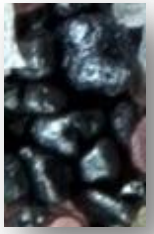
Shell

Sand Mineral Identification

- **Dark Color / High Density Minerals**
  - *Garnet*: light pink to red, translucent (Garnet is the New York State mineral)
  - *Staurolite*: dark orange to red, translucent (can be confused with Garnet)
  - *Magnetite*: dark metallic, strongly magnetic*
  - *Ilmenite*: iron-black to steel-grey, weakly magnetic*
  - *Hornblende*: black, opaque*
  - *Epidote*: yellow-green, translucent

Garnet

Staurolite



Black Minerals

Epidote

***A note about identifying the black metallic minerals:**
These can often be difficult to identify visually, but the differing levels of magnetism helps to tell the difference between Magnetite, Ilmenite and Hornblende. See the next page for instructions on identification.

Using the Magnet

- To tell the difference between Magnetite, Ilmenite and Hornblende:
  - Pour a small amount of your sample into the plastic dish
  - Take the magnet out of the sleeve
  - Run the magnet along the outside of the plastic dish and underneath it (do not put the magnet in the sand directly)
    - **Magnetite** will be strongly attracted to the magnet and will move around with the magnet
    - **Ilmenite** will be slightly attracted to the magnet, but will not move with the magnet
    - **Hornblende** will not be attracted to the magnet

NOTE:

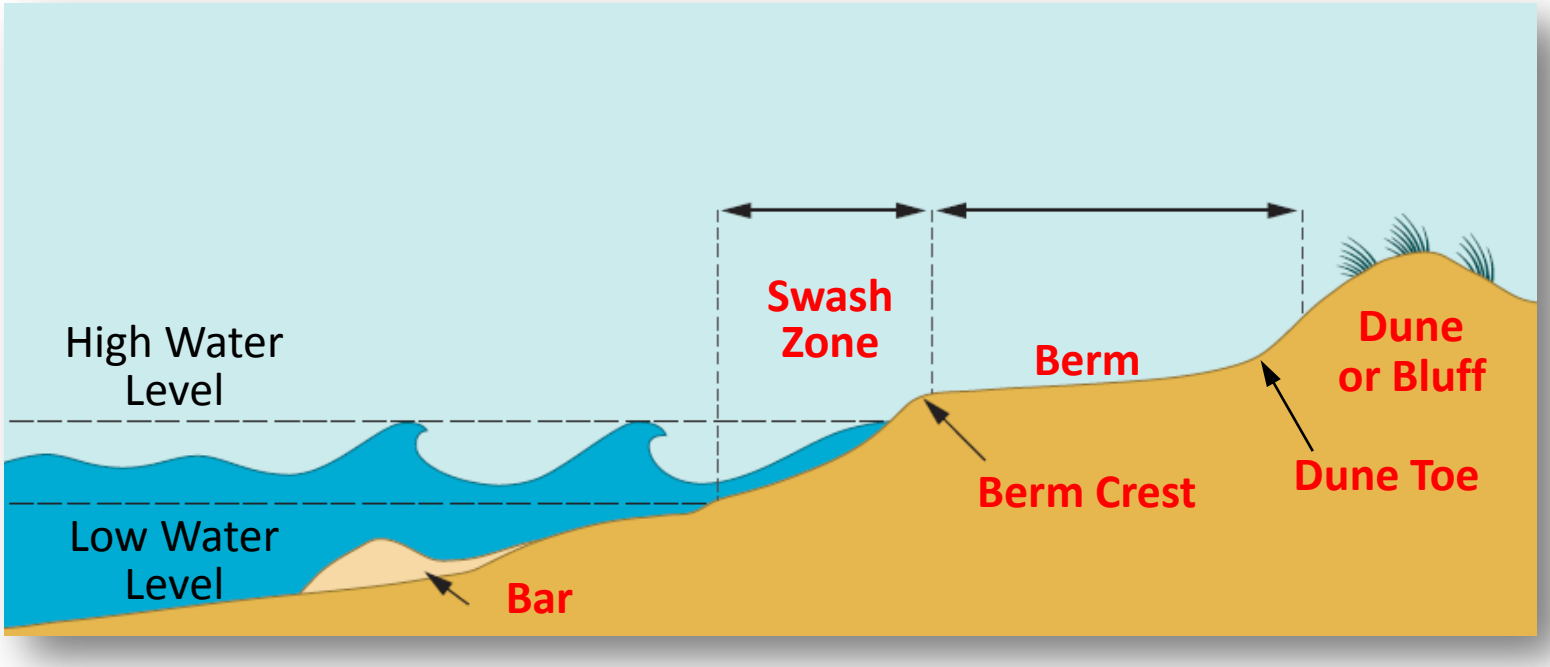
If the sand is damp due to waves or recent rain, the magnet will not be strong enough to move the magnetic minerals.

- Take a small sample back to the classroom and let it dry overnight.
- Or visit the Park's Visitors Centers and look at sand samples in the jars there.

Shape of a Beach

- Anatomy of a Beach
- Changes Through Time

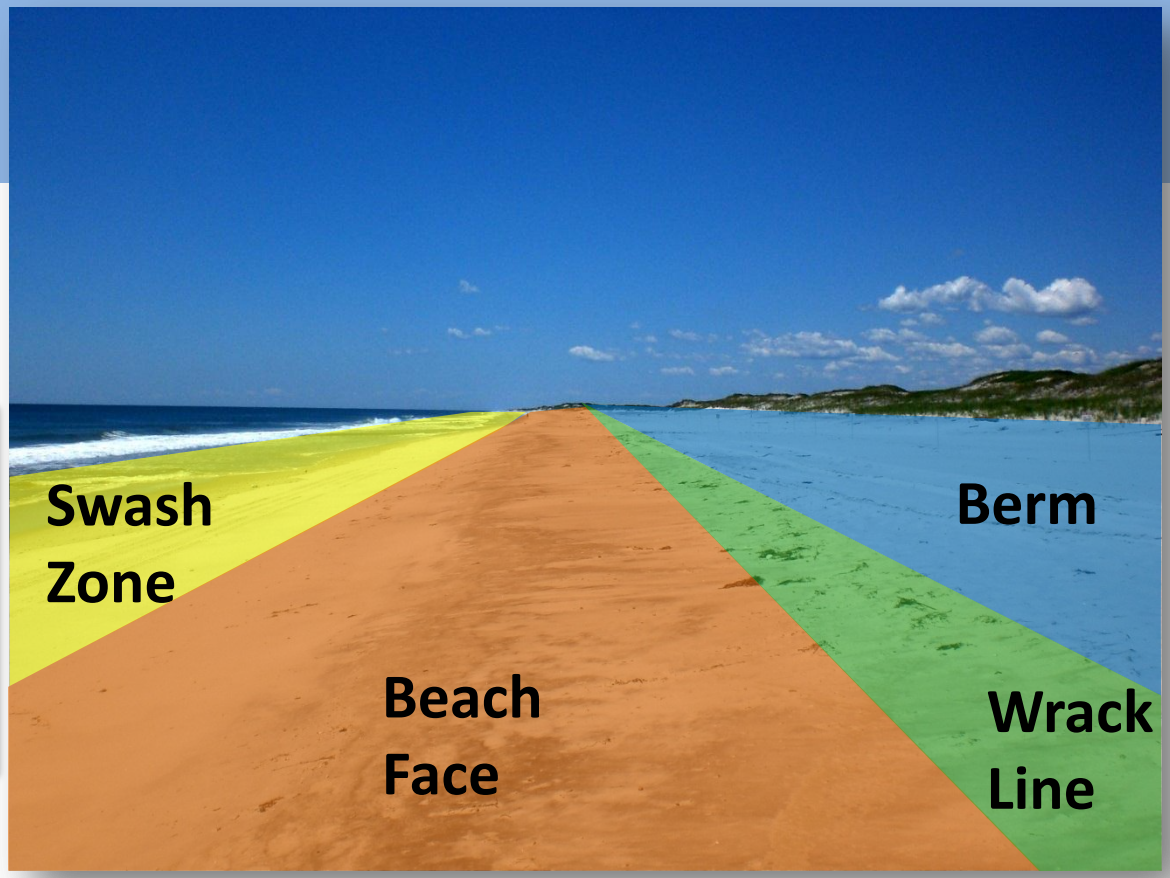
Anatomy of a Beach



A slice of the beach shows the different features.

These features change through time depending on the wind and wave conditions.

Illustration by John Norton, used with permission from New York Sea Grant



The area of the beach where the waves are breaking, swashing upon the shore.

The nearly horizontal portion of the beach that stays dry except for during storms and extremely high tides.

The highest reach of the daily tide, usually made of plant debris and may include trash.

The sloped area of the beach below the berm that is exposed to the swash of the waves over the course of the tide.

This picture was taken at or near low tide, so the swash zone is furthest away from the berm.

Beach Tip: **The best location for your beach towel is up on the berm where it should stay dry.**

The Beach Changes Through Time

- Periods of high energy waves move sand offshore.
- Sand can be stored in an offshore bar, leaving a narrow and steep berm on the beach.
- Periods of calm energy return the sand to the beach.
- Severe storms may erode the dune.

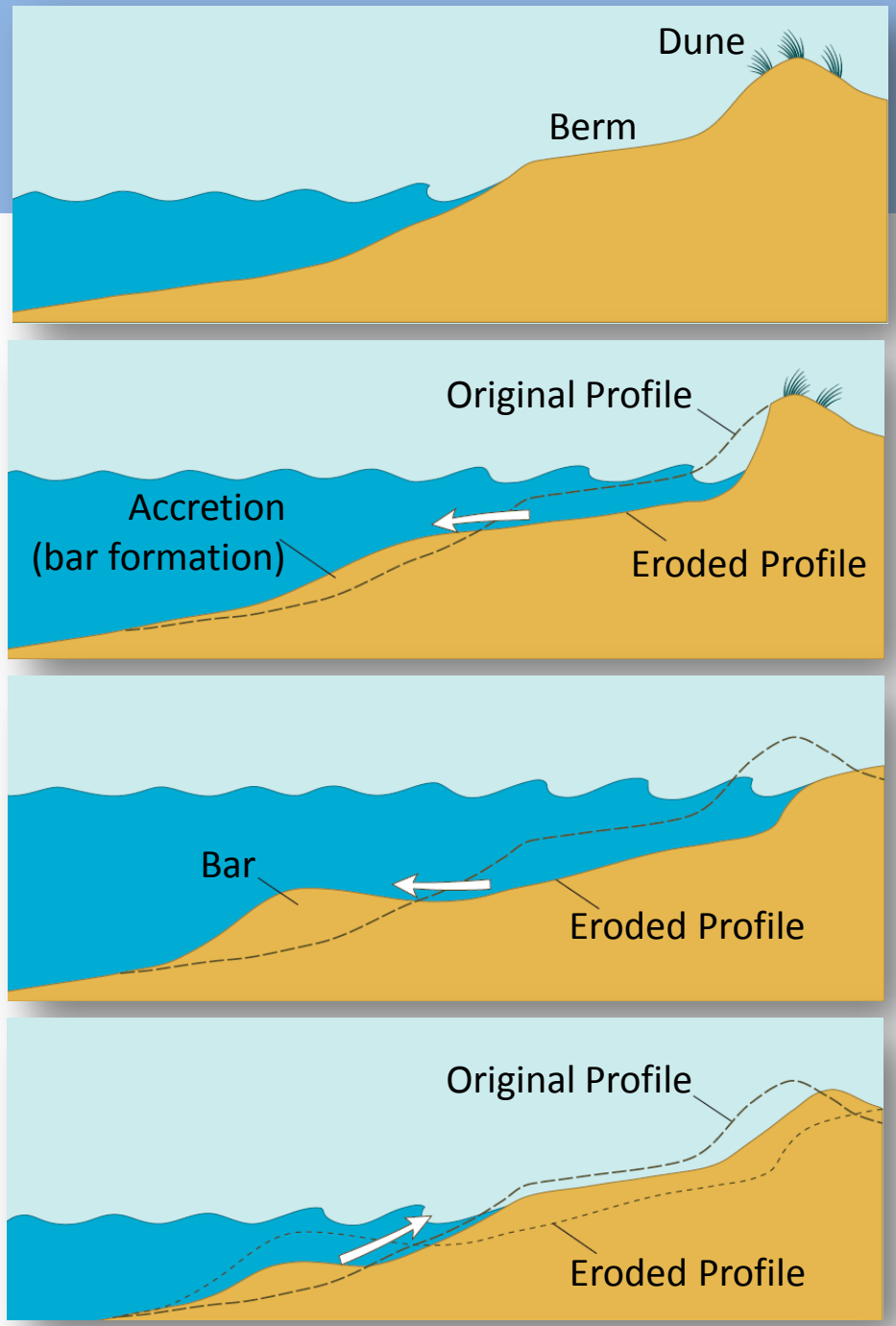


Illustration by John Norton, used with permission from New York Sea Grant

Features in the Wild

- Offshore Bar
- Scarp
- Wrack Line
- The Dune

Offshore Bar

At or around low tide, you may be able to see evidence of an offshore bar in the form of two lines of breaking waves parallel to shore.

Berm with Scarp

- A scarp is a vertical “cliff” that may be found along the berm, it can be as short as a few inches or as tall as a couple feet.
- They are formed by storms or strong waves that move sediment temporarily offshore.
- After a storm, you might see a scarp on the beach, but over time, the sand will return, filling in the area originally left open.

Wrack Line

- The wrack line is what is left stranded on the beach by the highest tide of the day.
- You might find plant debris, shells, egg casings or trash here.
- Older wrack lines may be found further up on the beach, washed up by storms or higher tides during the monthly cycle.

Dune

- The ocean side of the dune is the first in line to defend against storm wave energy.
- A freshly eroded dune will be close to vertical, show the internal layered structure of the dune and be free of vegetation.
- As time passes, pieces of the dune will slump down creating a more gentle and stable slope and will slowly be recolonized by dune plants.

Carried Away

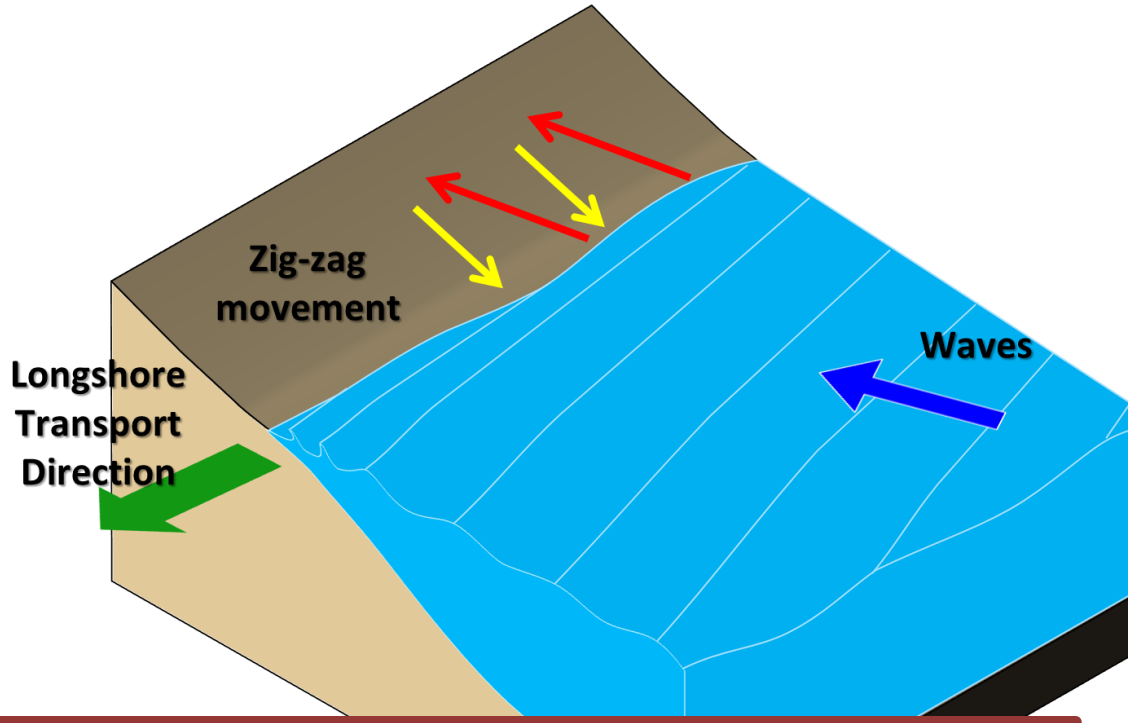
- Longshore Transport
- Rip Currents

Longshore Transport

Have you ever gotten out of the water after a swim and found you were further down the beach than when you got in?

Here's why:

Waves coming towards the shore at an angle move particles along the shore. This is called *longshore transport*.



- The waves push particles up the shore at an angle (**red** arrows).
- Water flows perpendicular back down the shore (**yellow** arrows).

Rip Currents

- Rip currents are channels of water flowing perpendicular away from the shore.
- They form when water is piled up between breaking waves and the beach.

Can you spot the rip currents in the picture above?

Rip Currents

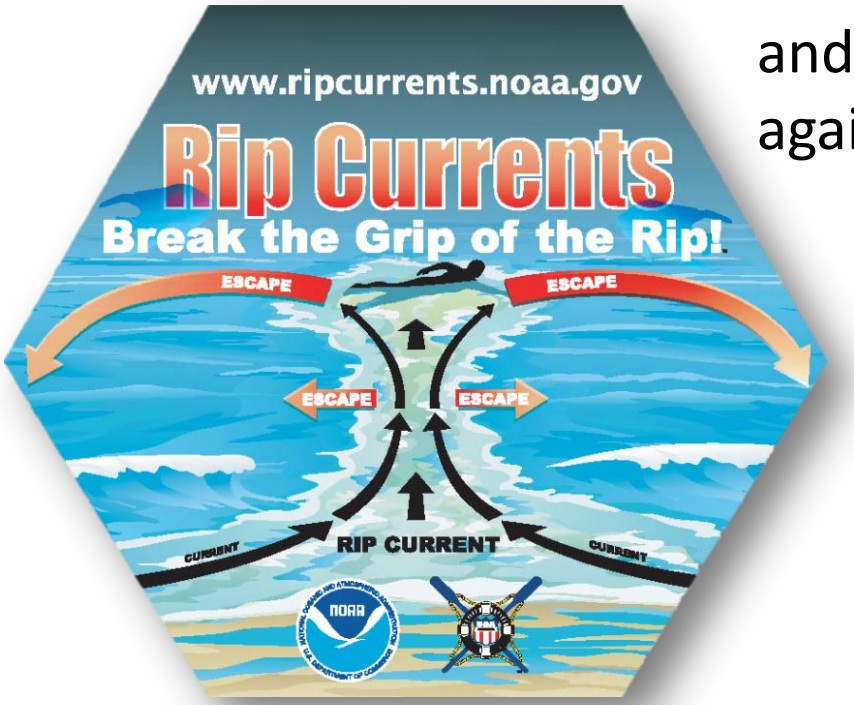
Rip Currents can look very different from one place to another.

They can be as narrow as 10 feet or as wide as 100 feet.

Here's what to keep an eye out for:

- Channel of churning, choppy water
- A noticeable difference in water color
- Line of foam, seaweed or debris moving seaward
- Break in incoming wave pattern
- <u>All or none of these may be present!</u>

Rip Currents



Rip currents can be dangerous for unaware swimmers who may be carried out to sea and can become exhausted if they swim against the current.

If you are caught in a rip current:

- **Do not try to swim against the current.**
- **Swim parallel to shore and angle towards shore only when you are free of the current.**

For more information visit:
www.ripcurrents.noaa.gov

Blowing in the Wind

- The Beaufort Scale
- Knots
- Wind Direction

The Beaufort Scale

Force	Classification	Wind Speed (knots)	Sea Conditions	Land Conditions
0	Calm	<1 kn	Sea surface smooth and mirror-like	Calm, smoke rises vertically
1	Light Air	1-3 kn	Scaly ripples, no foam crests	Smoke drift indicates wind direction, still wind vanes
2	Light Breeze	4-6 kn	Small wavelets, crests glassy, no breaking	Wind felt on face, leaves rustle, vanes begin to move
3	Gentle Breeze	7-10 kn	Large wavelets, crests begin to break, scattered whitecaps	Leaves and small twigs constantly moving, light flags extended
4	Moderate Breeze	11-16 kn	Small waves 1-4 ft becoming longer, numerous whitecaps	Dust, leaves and loose paper lifted, small tree branches move
5	Fresh Breeze	17-21 kn	Moderate waves 4-8 ft taking longer form, many whitecaps, some spray	Small trees in leaf begin to sway
6	Strong Breeze	22-27 kn	Larger waves 8-13 ft, whitecaps common, more spray	Larger tree branches moving, whistling in wires
7	Near Gale	28-33 kn	Sea heaps up, waves 13-19 ft, white foam streaks off breakers	Whole trees moving, resistance felt walking against wind
8	Gale	34-40 kn	Moderately high (18-25 ft) waves of greater length, edges of crests begin to break into spindrift, foam blown in streaks	Twigs breaking off trees, generally impedes progress

The Beaufort Scale

Force	Classification	Wind Speed (knots)	Sea Conditions	Land Conditions
9	Strong Gale	41-47 kn	High waves (23-32 ft), sea begins to roll, dense streaks of foam, spray may reduce visibility	Slight structural damage occurs, slate blows off roofs
10	Storm	48-55 kn	Very high waves (29-41 ft) with overhanging crests, sea white with densely blown foam, heavy rolling, lowered visibility	Seldom experienced on land, trees broken or uprooted, “considerable structural damage”
11	Violent Storm	56-63 kn	Exceptionally high (37-52 ft) waves, foam patches cover sea, visibility more reduced	
12	Hurricane	>64 kn	Air filled with foam, waves over 45 ft, sea completely white with driving spray, visibility greatly reduced	

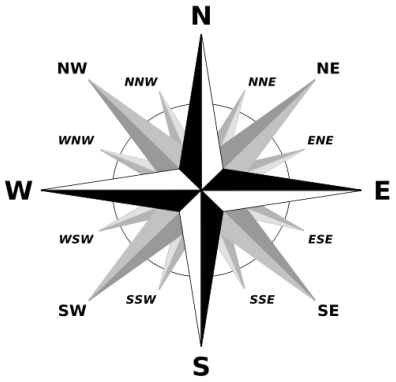
Credit:
NOAA Beaufort Wind Scale (http://www.spc.noaa.gov/faq/tornado/beaufort.html)

Knots

- A ***Knot*** is a unit of speed equal to *one nautical mile per hour*.
- To convert between knots and other useful units (meters per second or miles per hour) use the following relationships:
  - 1 nautical mile = 1.15 statute miles
  - 1 nautical mile = 1852 meters
  - 1 statute mile = 1609 meters
  - 1 hour = 60 seconds

Wind Direction

- Different groups of scientists use different conventions for naming winds.
- **Meteorologists** name winds for the direction the wind is coming from.
  - Wind coming from the north east, moving towards the south west would be called a *North Easterly* wind.
- **Oceanographers** name winds for the direction the wind is going towards.
  - Wind coming from the north east, moving towards the south west would be called a *South Westerly* wind.
- In this exercise, we are taking wind readings facing into the wind and, like meteorologists, will name winds for the direction they originate from.



A compass rose shows the 4 Cardinal directions, 4 Ordinal directions and 8 further subdivisions.
(Credit: Wikimedia Commons)